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ABSTRACT

This study analyzes the 1980s upturn in per capita consumption of dairy products in the United States. The study found that per capita consumption of total dairy products in the United States first trended downward then stagnated for the two decades prior to the early 1980s. Per capita consumption of items such as whole milk declined, whereas items such as lowfat milk and cheese tended to move upward. In the 1980s, per capita consumption of items such as lowfat milk and cheese increased at rates that more than offset decreases in other products, leading to an increase in the overall average consumption of dairy products. Despite a slowdown in the U.S. population growth rate, per capita consumption increased enough during the 1980s to generate the sharpest prolonged increase in total consumption of all dairy products at the national level in decades. Rising consumer incomes and declining prices for dairy products relative to other foods caused most of the 2 percent average annual increase in per capita consumption and the 3 percent increase in total consumption posted from 1983 through 1986. Advertising, concern about health and nutrition, changes in demographics, and government donations also affected consumption. However, these influences were small for most dairy products compared with the effects of changes in relative prices and consumer incomes. (Author/KC)

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March 1988

Consumer Demand for Dairy Products

A Summary Analysis

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U.S. DEPARTMENT OF EDUCATION
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This study analyzes the 1980's upturn in per capita consumption of dairy products in the United States. It was requested by the National Commission on Dairy Policy for use in preparing its March 1, 1988, report to Congress. This study focuses on identifying and, when possible, quantifying the major determinants of demand for dairy products.1/

Per capita consumption of total dairy products in the United States first trended downward then stagnated for the two decades prior to the early 1980's.2/ Per capita consumption of items such as whole milk declined while items such as lowfat milk and cheese trended upward. In the 1980's, per capita consumption of items such as lowfat milk and cheese increased at rates that more than offset decreases in other products, leading to an increase in the overall average consumption of dairy products.

Despite a slowdown in the U.S. population growth rate, per capita consumption increased enough during the 1980's to generate the sharpest prolonged increase in total consumption of all dairy products at the national level in decades.

Rising consumer incomes and declining prices for dairy products relative to other foods caused most of the 2-percent average annual increase in per capita consumption and the 3-percent increase in total consumption posted from 1983 through 1986. Advertising, concern about health and nutrition, changes in demographics, and Government donations also affected consumption. But these influences were small for most dairy products, compared with the effects of changes in relative prices and consumer incomes.

DAIRY MARKET CHARACTERISTICS

Several characteristics of the dairy market contribute, either directly or indirectly, to shaping consumption of dairy products.

From a supply perspective, the dairy sector is more heavily regulated than most other domestic agricultural industries. The Commodity Credit Corporation program authorized by the Agricultural Act of 1949 and the milk marketing orders authorized by the Agricultural Marketing Agreement Act of 1937 provide both price and income support to milk producers. Supports are implemented through direct Government purchases of manufactured dairy products to maintain

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1/ As requested by the Commission, this study is limited to analyzing demand relationships at the consumer level. Hence, specific linkages between farm and retail level price movements are not examined.

2/ Total dairy products on a milk-equivalent, milkfat basis.

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minimum prices consistent with program targets. Imports are also restricted because foreign dairy products are generally available at lower- often subsidized--prices. Less than 4 percent of U.S. dairy products move abroad, mostly through assistance programs, and imports are limited to a roughly comparable share of the market. Hence, producers depend heavily on the domestic market and program decisions about support pricing.

From a consumption perspective, per capita use of dairy products has tended to decline over the long run. For example, while consumption in several individual product categories such as cheese and lowfat milk rose, overall consumption including donations of dairy products declined from a 1939 peak of 824 pounds per capita to a low of 542 pounds in 1981. Population over the period grew fast enough to keep total consumption rising slowly from 108 billion pounds to 123 billion pounds over the same period.

These supply and use characteristics combined in the late 1970's and early 1980's to generate large surpluses. Milk support prices were raised from $3.71 per hundredweight (cwt) in 1965 to a high of $13.49 for a short period in 1981. This rise stimulated production through its effects on cow numbers and milk yields per cow. While many factors including processing and marketing costs affect retail prices, milk support prices also influenced retail prices for dairy products. While retail dairy product prices declined relative to other food prices during at least part of this period, they were still likely higher than they would have been without milk price supports. High support prices also encourage the production and use of dairy substitutes.

With these forces at work, Government purchases on a milk-equivalent basis increased from 1 to 6 percent annually in the 1970's to a peak of 12 percent of farm marketings in 1983 when rising budget outlays stimulated program changes. Under resulting 1983 and 1985 changes in dairy legislation:

- Support prices were linked directly to the amount of Government purchases beginning on April 1, 1985. From April 1 on, milk support prices fall when Government purchases exceed specified levels. Support prices have fallen six times in the intervening 35 months from $13.10 in November 1983 to $10.60 per cwt in January 1988.

- The Temporary Emergency Food Assistance Program (TEFAP) sharply expanded cheese and butter donations to low-income consumers during 1983-85. TEFAP reduced donations slightly in 1986. Donations allowed some groups to consume more dairy products (or to substitute products such as butter for margarine) without purchasing the products in commercial outlets.

- Dairy producers began paying assessments in 1984 to support research and promotion activities. The assessment of 15 cents per cwt on all milk marketed generates about $200 million annually, most of which is spent on advertising and promotion. Expenditures for advertising dairy products have more than doubled over pre-1984 levels.

COMPOSITION OF THE 1983-86 INCREASES IN DAIRY CONSUMPTION

Per capita consumption of dairy products, excluding donations, increased an average of 2 percent per year in 1983-86, after declining an average of 1.5

percent per year from the mid-1960's to the mid-1970's and then leveling off until the early 1980's (fig. 1).

Most of this increase came from greater consumption of cheese. Per capita consumption of most other dairy products showed modest gains or stabilized. Per capita consumption of fluid milk rose modestly after long declines. Butter consumption per capita increased, but most of this increase was due to greater donations. Evaporated, condensed, and dry milk consumption per capita increased after long declines. Frozen dairy products posted minor increases. However, gains in these categories contributed little to expanding total per capita consumption because of their relatively small volumes.

Per capita cheese consumption, including donations, has grown over 4 percent per year and has more than doubled since 1966. It is one of the few dairy products with steadily rising per capita consumption. This growth has been mainly in the away-from-home market and as ingredients in the processed-foods market. Strong growth in the pizza market has been particularly important. Home consumption of cheese per person declined from 1980 to 1984 and increased slightly from 1985 to 1986 due primarily to growth in processed cheeses (such as packaged, sliced American cheese). About 38 percent of cheese is consumed at home, about 39 percent away from home, and about 23 percent as ingredients.

Although per capita fluid milk consumption increased in 1982-86, the total increase (3.5 pounds) was not large enough to push consumption above the 1981 level of 245 pounds. Per capita consumption of fluid milk and cream has declined an average of 1 percent per year from 292 pounds in 1965 to 242 pounds in 1982. But this decline in fluid milk and cream products masks a rather significant change in its components: lowfat milk has steadily replaced whole milk. Per capita consumption of whole milk declined about 3 percent per year from 246 pounds in 1965 to 118 pounds in 1986. Other milk, mostly lowfat milk, increased at an average annual rate of 5 percent from 39 pounds per capita in 1965 to over 119 pounds in 1986.

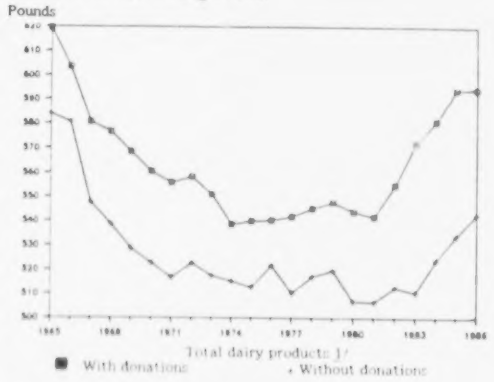
Since 1976, per capita butter consumption excluding donations has stabilized at about 4.0 pounds, after declining 3.5 percent per year from 6.4 pounds in 1965. About 30 percent of butter is consumed at home, with 70 percent consumed in the ingredient and away-from-home markets. Butter consumed at home declined; the share consumed away from home and as ingredients increased.

Per capita consumption of frozen dairy products was relatively stable during 1965-86, rising from 26.8 pounds in 1965 to 28.1 pounds in 1986. Per capita consumption of ice cream, the largest component, was 18.5 pounds in 1965 and 18.3 pounds in 1986. Ice cream and related products consumed at home has increased since 1980.

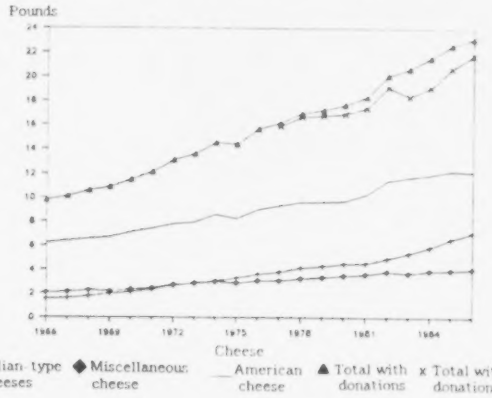
Per capita consumption of evaporated and condensed milk products declined about 3 percent per year from about 16 pounds in 1965 to a low of 7 pounds in 1980, where it remained until 1984 before increasing to 7.9 pounds in 1986. Consumption of dry milk products fluctuated between a high of 7.4 pounds (1973) and a low of 5.6 pounds (1981). Since 1981, consumption increased to 7.2 pounds per capita by 1986. But without donations, consumption would have increased from 5.4 to 6.6 pounds.

Figure 1--After historical declines, per capita consumption of total dairy products increased in the 1980's*

Excluding Government donations gives a clearer picture of consumption: per capita consumption rose in 1983 and has continued to rise through 1986.

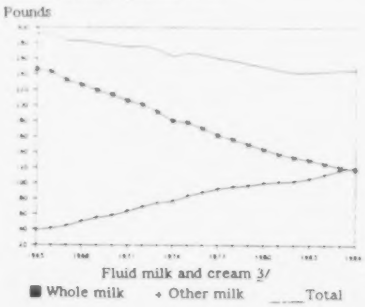


Almost all the increase in dairy products is attributable to the continued rise in per capita cheese consumption.

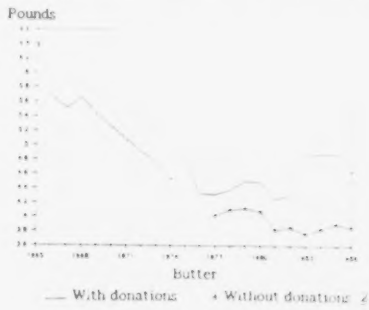


Per capita consumption of most other dairy products increased slightly.

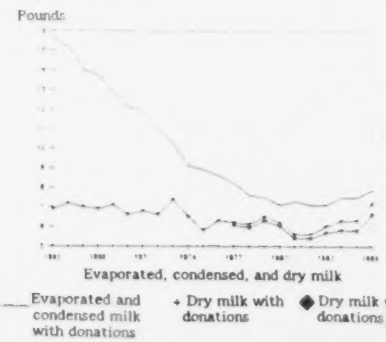
Fluid milk and cream increased slightly, after long declines. Consumption of lowfat milk is steadily replacing whole milk.



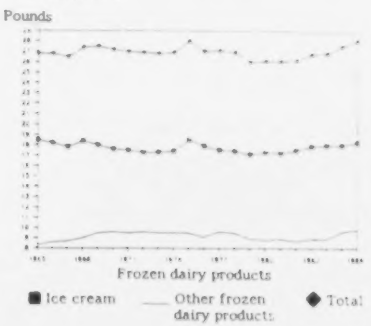
Recent increased donations raised butter consumption. Without donations, consumption levels out.



Consumption of evaporated, condensed, and dry milk rose.


Pounds
Evaporated, condensed, and dry milk
Evaporated and condensed milk with donations
Dry milk with donations
Dry milk without donations 2/

Consumption of frozen dairy products shows little variation.



*Charts not drawn on proportional scales.
1/ Total dairy products on a milk-equivalent, milkfat basis.
2/ Data on donations of individual dairy products were not available prior to 1977.
3/ Including donations.

PRICE AND INCOME EFFECTS ON DEMAND

The effects of prices and income on per capita consumption were measured using a complete demand system based on time series analysis. Statistical measures indicate that these two factors explain most of the movements in per capita levels. The difference between actual and simulated per capita levels was less than 5 percent for all dairy products. Analysis of income effects from household survey data also pointed to the importance of changes in income in shaping per capita consumption.

Time-Series Analysis

The analysis summarized here suggests that demand for dairy products is sensitive to a number of factors but that sensitivity to changes in relative prices and income is the most pronounced. This sensitivity combined with sharply rising consumer incomes and falling dairy prices relative to other foods generated most of the 1983-86 increase in consumption.

Retail prices for dairy products have risen less than most other foods for most of the 1980's. Dairy product prices rose an average of 1.2 percent annually since 1981, while prices for all other foods rose more than 3 percent (measured using the Consumer Price Index). This effectively lowered relative dairy product prices. Consumers' purchasing power (real disposable per capita income) also increased over 3 percent per year during 1983-86, an increase over the 2-percent pace of the 1965-83 period.

The sensitivity of dairy demand to changes in prices and incomes was gauged using econometric models of demand relating per capita consumption of broad food aggregates to prices and incomes. The models were also used to determine the effects of prices and income on per capita consumption of specific dairy products. The models are described briefly in the box and in greater detail in the full report.

This sensitivity analysis suggests that:

Decreasing prices increases consumption. A 10-percent decrease (increase) in price increases (decreases) per capita consumption of total dairy products by about 3 percent, all other factors remaining constant (fig. 2 and table 1). Table 1 also shows the estimated relationships between price changes and consumption changes for the major individual dairy products. Decreasing prices by 10 percent:

- Raises per capita consumption of cheese 3.3 percent;
- Raises per capita consumption of fluid milk 2.6 percent;
- Raises per capita consumption of butter 1.7 percent;
- Raises per capita consumption of evaporated, condensed, and dry milk products by 8.3 percent; and
- Raises per capita consumption of frozen dairy products 1.2 percent (fig. 2, table 1).

Increased income does not always raise consumption. A 10-percent increase (decrease) in income increases (decreases) per capita consumption

(continued on p. 10)

Prices and Income Affect Demand for Dairy Products

This section examines what happens to the quantities of dairy products consumed when prices and incomes change. Elasticity estimates were obtained from time-series econometric models that incorporated prices of all foods, an index of nonfood prices, and income.* These elasticities measure the percentage change in the quantity consumed for a given percentage change in price or income (see table 1). Changes in price or income were assumed to have a negligible effect on per capita consumption when the elasticities were smaller than their standard errors. For example, changes in income had little or no effect on consumption of butter and frozen and other dairy products because the elasticities were smaller than their standard errors.

Household survey data were used to estimate income elasticities for the at-home component of the market. The data are based on cross-sectional expenditure observations and can be used to develop measures of the effects of income when factors other than just prices and income are considered.

Estimated price elasticities show that a change in price affects consumption in the opposite direction; all price variables have negative coefficients. For example, a -0.31 elasticity indicates that a 10-percent decrease in price increases per capita dairy consumption about 3 percent (table 1). A change in income affects consumption in the same direction if measured in terms of a dairy product total. But the effect of a change in income on the consumption of individual products differs as reflected in both the sign and the magnitude of the elasticities (table 1).

Econometric models, from which the time-series estimates in table 1 were obtained, were used to simulate annual per capita consumption levels for the dairy product categories shown in table 1. The simulated and actual per capita consumption levels for individual dairy product categories over 1954-86 correspond closely (fig.3). Statistical measures of the discrepancy between the actual and

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* See Huang, K.S. U.S. Demand for Food: A Complete System of Price and Income Effects, TB-1714, U.S. Dept. Agr., Econ. Res. Serv., Dec. 1985; and Huang, K.S. and Haidacher, R.C. "Estimation of a Composite Food Demand System for the United States," Journal of Business and Economic Statistics, Vol. 1, No. 4 (Oct. 1983), pp. 285-91.

simulated levels show that, on average, the discrepancy relative to the mean of actual per capita consumption was less than 5 percent for all dairy product categories. Other studies using econometric models also show that prices and income significantly influence per capita consumption.

Table 1--Price and income elasticities for dairy products 1/

Products	Price elasticity (time-series)	Income elasticity (time-series)	At-home income elasticity (household survey)
		Coefficient	
Total dairy products	-0.31	0.18	0.14
	(.03)	(.05)	--
Fluid milk	-.26	-.22	.02
	(.12)	(.07)	--
Cheese	-.33	.59	.32
	(.12)	(.12)	--
Butter	-.17	.02	.35
	(.17)	(.19)	--
Evaporated, condensed, and dry milk	-.83	-.27	-.12 2/
	(.26)	(.22)	--
Frozen and other dairy products	-.12	.01	.21
	(.08)	(.06)	--

Note: The upper numbers are the elasticity estimates. The numbers in parentheses are the standard errors.

-- = Standard errors of elasticities were not calculated but elasticities are derived from statistically significant parameter estimates (except for fluid milk).

1/ Note that the elasticities in columns 1 and 2 relate product consumption to prices and income, while the elasticities in column 3 measure the responsiveness of product expenditures to income changes.

2/ Includes only canned milk.

Figure 2- Per capita consumption of all dairy products would rise if prices fell 10 percent

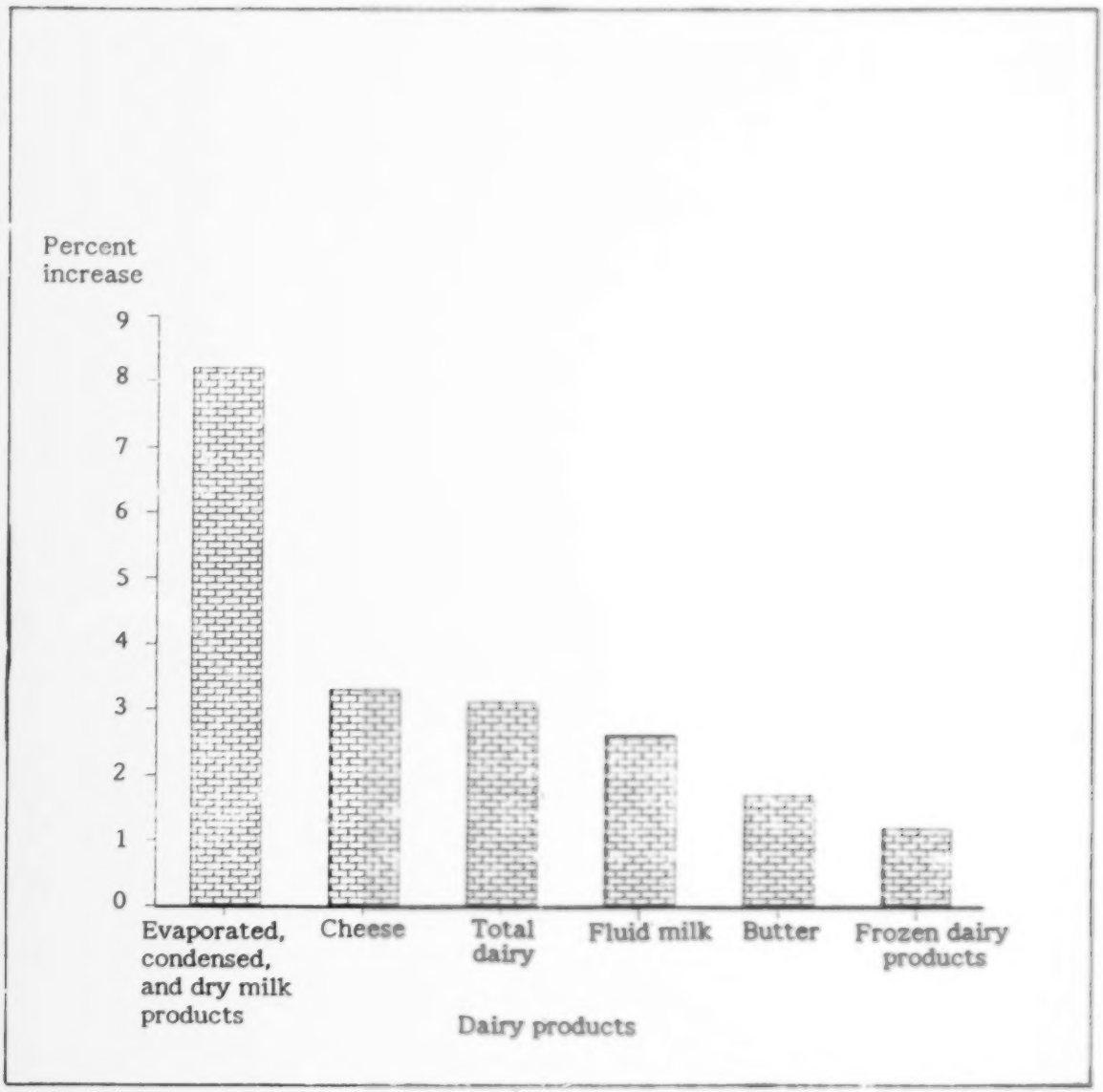
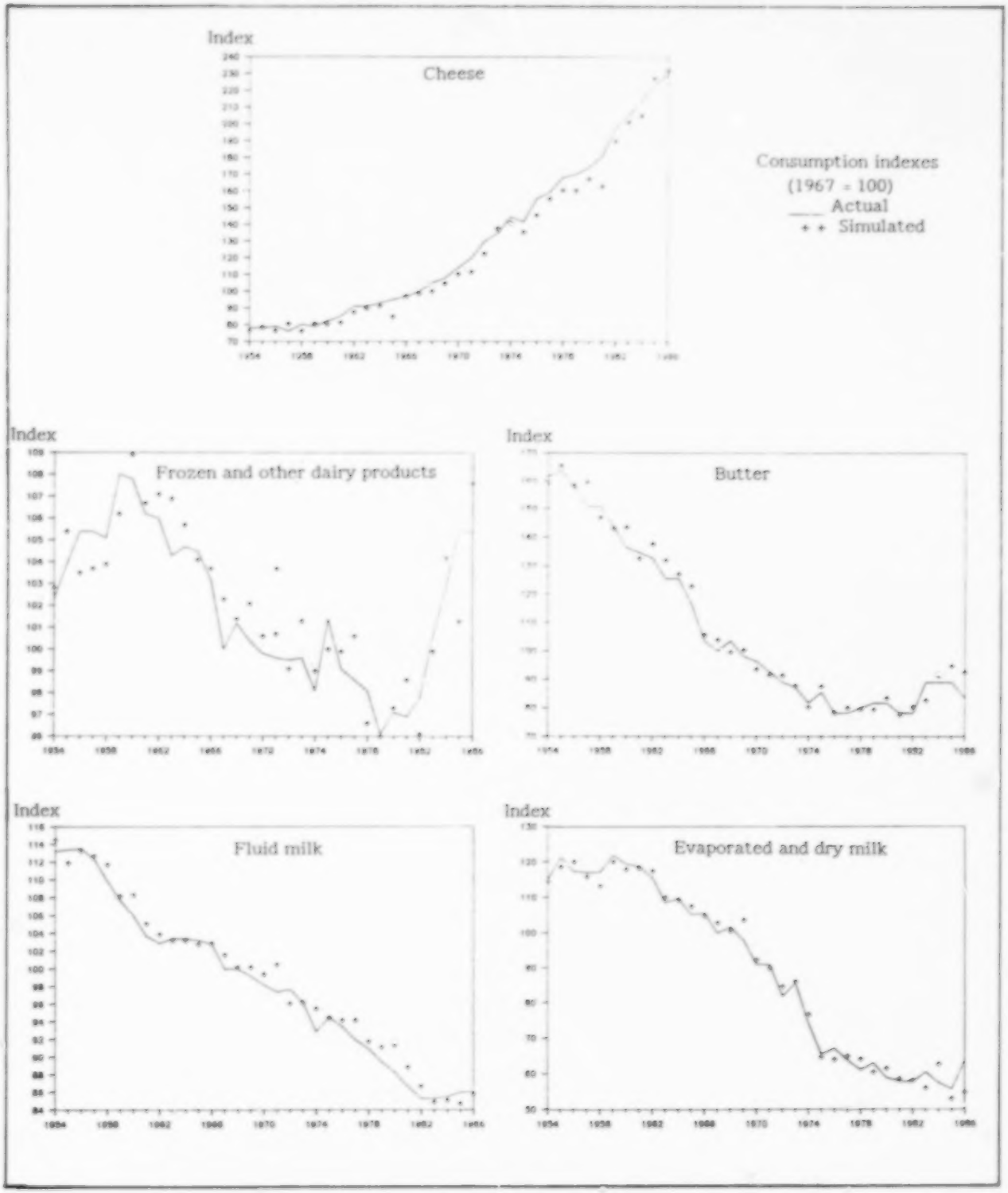


Figure 3- Simulated annual per capita consumption of dairy products



of total dairy products 1.8 percent (table 1). But this same 10-percent increase in income affects individual dairy products differently. It:

- o Lowers per capita consumption of fluid milk about 2.2 percent;
- o Lowers per capita consumption of evaporated, condensed, and dry milk products 2.7 percent;
- o Hardly affects per capita consumption of butter and frozen dairy products; and
- o Raises per capita consumption of cheese about 6 percent.

These income elasticities are based on time-series demand models. Since it is difficult to isolate the effects of time trends and income on consumption in time-series analysis, it should be recognized that the income elasticities may embody trend effects.

Household Survey Analysis

Elasticities derived from household expenditure surveys provide an added measure of the sensitivity of demand to changes in income that are also free of trend effects. The time-series elasticities shown in columns 1 and 2 of table 1 are measured in quantity terms while the survey elasticities shown in column 3 are measured in terms of expenditures for at-home use only. A 10-percent increase in income increases per capita at-home expenditures on total dairy products 1.4 percent (table 1). As in the time-series analysis, a 10-percent increase in income affects per capita at-home expenditures on individual dairy products differently. Such an increase:

- o Has little or no effect on per capita fluid milk expenditures;
- o Lowers per capita expenditures on canned milk 1.2 percent;
- o Raises per capita expenditures on frozen and other dairy products 2.1 percent; and
- o Raises per capita expenditures on butter and cheese over 3 percent each.

OTHER FACTORS ALSO AFFECT DEMAND FOR DAIRY PRODUCTS

While changes in relative prices and consumer income explained much of 1983-86's consumption gains, other factors such as advertising, concern about health and nutrition, and Government donations also influenced consumption.

Demographic changes, except population growth, have little influence on year-to-year changes in consumption at the national level because factors such as regional, racial, and age distributions change slowly over time. Even in the long run, the combined effect of the changes in these factors projected to 2000 would increase per capita cheese consumption at home by less than 1.4 percent (table 2). Demographic factors are more important, however, in explaining variations in expenditures between households and between at-home and away-from-home consumption.

Advertising may also have bolstered per capita consumption of some dairy products, especially fluid milk and cheese. But the effect appears to have been small when compared with price and income effects.3/ After netting out the effects of other factors, fluid milk advertising appears to have mitigated a downward trend in consumption rather than to have generated any absolute increases. Current research on cheese advertising is available only on the at-home market. Since increases in cheese consumption are attributed to away-from-home markets, the only measured advertising effect has been to slow the decline in at-home consumption.

There is little, and ambiguous, evidence on how attitudes about health and nutrition affect purchases of dairy products. For example, one study showed that the dietary intake of calcium has increased so far in the 1980's, but that the share coming from dairy products has decreased. Also, the consumption of lowfat milk is steadily replacing whole milk, yet cheese consumption is rising despite apparent consumer awareness about fat and cholesterol.

Government donations of dairy products from surplus stocks displaced some commercial sales. For example, cheese donations under TEFAP increased

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3/ This report makes no attempt to analyze whether advertising has increased sales enough to justify the advertising expenditures. The National Commission on Dairy Policy requested that a group of university researchers conduct a separate study to evaluate advertising effectiveness.

Table 2--Projected changes in expenditures for food consumed at home due to shifts in demographics

Shifts	Changes in expenditures from 1980 levels				
	Milk and cream	Other dairy products 1/	Cheese	Butter	Total dairy products
	Percent				
Age distribution:					
1990	-0.2	0.5	1.0	1.1	0.5
2000	-.9	2.1	1.9	1.8	1.6
Regional distribution:					
1990	-.1	.1	-.2	-.7	-.1
2000	-.2	.3	-.4	-1.3	-.1
Racial distribution:					
1990	-.3	-.2	-.5	-.2	-.3
2000	-.5	-.4	-.1	-.3	-.6
Total change: 2/					
1990	-.6	.4	.3	.2	.1
2000	-1.6	2.0	1.4	.2	.9

1/ Includes evaporated, condensed, and dry milk, and other dairy products.
2/ Net adjustment after accounting for projected changes in all demographic variables.

substantially in 1983-86 over pre-1983 levels. Research conducted by USDA's Economic Research Service has shown that each 100 pounds of cheese donations displaces about 35 pounds of commercial purchases. A pound of TEFAP butter donations displaces virtually no butter but displaces an equal amount of margarine purchases.

This report summarizes *Consumer Demand for Dairy Products*. Copies are available from USDA-ERS Information, Room 237, 1301 New York Avenue, NW., Washington, DC 20005-4788. Phone: (202) 786-1512. For technical information about the report, call Richard Haidacher at (202) 786-1862.

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